81228

APR 12 1989

Mr. Peter Keppler
Vice-President & General Counsel
AMAX Environmental Services, Inc.
1707 Cole Boulevard
Golden, Colorado 80401-3293

Dear Mr. Keppler:

As you are aware, the Environmental Protection Agency (EPA) and Cherokee County Superfund site PRPs met on April 10, 1989. Part of the discussions at that meeting pertained to the enclosed work plan for field pilot testing of the remedial alternative recommended by the PRPs and modifications on that alternative. The PRPs suggested some variations on the work plan and set up a technical meeting via telephone for April 12 to continue those discussions. On April 17, 1989, the EPA and the PRPs will meet again via telephone to finalize the plans for the pilot testing and to discuss the ~~potential~~ PRPs' participation in the testing program. You may participate in this conference call on April 17 at 10:00 a.m. EDT by calling (202) 245-3841.

possible

Sincerely yours,

Alice C. Fuerst
Cherokee County Project Manager
Superfund Branch
Waste Management Division

Enclosure

WSTM:SPFD:REMD:Fuerst:pgs:3/31/89:FUE8-18 4/12/89

REMD	REMD	CNSL	SPFD
Fuerst	Wright	Kloeckner	Sanderson
Fuerst 4-12-89	4/12/89	Concurs with corrections. EJK 4/12/89	Kos 4/12/89

Mr. Peter Keppler
Vice-President & General Counsel
AMAX Environmental Services, Inc.
1707 Cole Boulevard
Golden, Colorado 80401-3293

Mr. John Richardson
ASARCO, Inc.
3422 South 700 West
Salt Lake City, Utah 84119

Ms. Corinne Faris
Eagle-Picher Industries, Inc.
580 Walnut Street
Cincinnati, Ohio 45202

Mr. Mitchell H. Bernstein
Skadden, Arps, Slate, Meagher & Flom
1440 New York Avenue, N.W.
Washington, D.C. 20005-2107

Mr. Thaddeus Zalenski
LTV Steel Company
Law Department
LTV Steel Building
25 West Prospect Avenue
Cleveland, Ohio 44115

Mr. Thomas J. Erbs
Erbs & Erbs, P.C.
1655 Des Peres Road
Suite 135
St. Louis, Missouri 63131

Mr. Barry Sams
NL Industries, Inc.
Post Office Box 1090
Hightstown, New Jersey 08520

Mr. Thomas L. Aldrich
Household Manufacturing
2700 Sanders Road
Prospect Heights, Illinois 60070

Mr. Dale Guariglia
Bryan, Cave, McPhetters and McRoberts
500 North Broadway
St. Louis, Missouri 63102-2186

Ms. Laura Grossi-Tyson
Sun Company, Inc.
1801 Market
Philadelphia, Pennsylvania 19103

Mr. Timothy M. Sadler
Sharon Steel Natural Resource Division
999 18th Street, Suite 1000
Denver, Colorado 80202

Ms. Elisa Rivlin
Gulf & Western Industries
1 Gulf & Western Plaza
38th Floor
New York, New York 10023

Ms. Sue Wilson
Legal Department
E.I. DuPont
BOD 812-2
Wilmington, Delaware 19898

Mr. Larry Knoche
Kansas Department of Health & Environment
Building 740, Forbes Field
Topeka, Kansas 66620

WORK PLAN REVISION REQUEST NO. 3

TECHNICAL ASSISTANCE FOR
THE CHARACTERIZATION OF MINE WASTES
GALENA SUBSITE
CHEROKEE COUNTY, KANSAS

APRIL 1989

EPA W.A. NO. 223-7L37

Section 1
INTRODUCTION

This is the third revision to the scope of work for the Galena operable unit technical assistance work assignment. This revision includes the addition of a new project number (DEN67902) to permit separate accounting of funds and LOE hour expenditures for the proposed tasks included in this Work Plan Revision Request (WPRR).

This WPRR has been developed to accomplish two primary objectives. First, it will describe the supplemental field pilot testing activities that require funding so work can begin early this spring. Second, it will provide the supporting rationale for this work based upon the chronology of events that have taken place on the project to date.

Section 2
BACKGROUND

The original scope of work for the Galena technical assistance task was to provide additional technical and cost information to support the preferred remedy determined by EPA in 1988. The task was to determine, through field sample collection and metallurgical test work, the most appropriate combinations of treatment parameters for processing and removal of lead, zinc, and cadmium metals from the surface mine wastes at the Galena subsite.

These parameters were to provide guidance in studying and revising as necessary the metallurgical unit processes described in the preferred remedy consisting of crushing, grinding, and mineral flotation. Samples of mine wastes, including chat, were collected for laboratory testing. Mine waste rock samples that represented the high grade (high metal content) feed materials and chat samples to represent the low grade (low metal content) feed materials were collected. During the field sampling event, several chat piles were analyzed for lead and zinc concentrations using a portable XRF. The analytical results from the XRF indicated that some of the chat piles had total bulk lead and zinc concentrations in excess of 1,000 ppm and 20,000 ppm, respectively. It was difficult to use the XRF to analyze the mine waste rock because of the wide particle size range of the material (nominal 24-inch-diameter rocks to dusty, fine sand-size materials). Therefore, it was decided that the high grade material sample would have to be collected using observational methods based on the visual presence of mineralization. Using visual methods, mine waste rock was collected that contained high levels of lead and zinc mineralization. A chat pile, its sample containing particularly high lead and zinc (as determined by XRF measurements), was selected for use as the low grade testing sample. These samples were sent to the subcontract laboratory for wet chemical analysis and metallurgical testing.

During the laboratory testing program, considerable physical and chemical data were noted, with two items of particular interest. First, the higher lead and zinc metal concentrations in the chat samples were found to be in the minus 35 mesh (less than 500 microns) fraction of the samples. Second, the processing circuits had to be much more complex than first anticipated in the preferred remedy. The preferred remedy proposed the use of conventional sulfide flotation for the removal of the lead and zinc metals from the crushed and ground mine waste materials. Because the oxidation of both the galena (lead sulfide) and sphalerite (zinc sulfide) minerals was more extensive than expected, these standard metallurgical flotation practices would not provide an adequate recovery. Therefore, a more complex five-stage flotation circuit was developed using a two-stage sulfide flotation circuit and a three-stage oxide flotation circuit to provide an adequate recovery, thus leaving concentrations of lead and zinc in the tailing at acceptable levels.

Additional laboratory testing of the chat samples, including wet screening and chemical analyses, was performed. These tests indicated that approximately one half of the chat samples collected contained lead concentrations in excess of 700 ppm (bulk basis). In order to reduce the milling process volume, the contaminated fraction of the chat could be separated using a wet screening process, and the fines containing the bulk of the lead and zinc metals could then be fed to the central mine waste processing plant. In addition, to assure only contaminated chat was processed, piles would be characterized in the field using a field portable XRF. The PRP Group estimated the quantity of mine waste rock at about 500,000 tons and total chat tonnage of about 1,000,000 tons. Using these new data, process flowsheets for the preferred remedy were revised and new estimates of capital and operating costs were made. The new cost estimates exceeded the original cost estimate included in the preferred remedy.

A technical supplement report is being prepared to identify additional alternatives that may satisfy the clean-up criteria for the Galena subsite and possibly be more cost-effective than the previously defined EPA preferred remedy. As a result of PRP test work, they suggested an alternative to backfill the mine voids with high metal content mine waste below the water table, low metal content wastes above the water table, and negligible metal content wastes for the surface cover. After a review of these data, it is CH2M HILL's professional opinion that placing the mine wastes into mine voids that contain acidic and oxygenated groundwater would release additional metals into solution. Recent stir tests performed by EPA, using mine waste rock and water acidified to a pH of 4 to represent acidic groundwater in the mine voids, provided data that indicate metals in the finer size waste rock fraction are very soluble in dilute acidic water. The tests substantiate the chemical reactions anticipated which dissolve the sulfide metals from the host rock, thus creating more acid and thereby enhancing the metals mobilization process.

As a result of EPA's tests, a modified approach to backfilling the mine waste was considered. This alternative considers placing larger sized mine waste rock, mixed with the chat containing lead, zinc, and cadmium concentrations that would minimally affect the groundwater, into the existing mine workings below the water table. This is preferable since the lesser surface area will reduce dissolution reaction kinetics. In addition, the finer waste rock material typically contains far more mineralized material to react with the acidic groundwater. Finer grained, geochemically more active waste rock and chat containing lead levels above the action level would be placed above the water table and covered with chat that does not exceed the action level for lead. The combined grain size and geochemistry of the mine wastes, and chat to be studied under this work plan, will be used to determine the optimum practical size to be used in the screening process. Field pilot scale testing that are proposed for this alternative and the PRP alternative will also determine

the probable geochemical response of these materials in the acidic groundwater.

Field pilot leach tests will also provide additional data on backfilled material permeability, its impact on groundwater flow and metals solubility in the acidic groundwater environment. These tests would be similar to laboratory testing, but on a much larger scale to recognize the actual larger particle sizes in the mine waste rock. The field pilot testing will provide valuable information towards determining the selection of the new preferred remedy.

Section 3
PROJECT SCOPE

The field pilot testing to compare these two possible alternatives for site remediation will be accomplished in two phases. Because of the tight timetable for this project, any significant change or modification to the scope may not permit this project to be completed in the allowed time.

PHASE I. CHARACTERIZATION

The first phase will be used to reconnoiter the site, then characterize and select two mine waste rock types, one of silicate characteristics and one of carbonate characteristics, that reasonably represent the two principal types of mine waste rock scattered about the Galena subsite. A test site location will also be selected and access approvals obtained during this phase. In addition, chat sources with varying lead and zinc concentrations will be located.

The PRP alternative states that the mine wastes will be classified into three material types--one containing high metals concentrations, one containing medium metals concentrations, and one containing low metals concentrations. The PRP's have not defined what concentration limits define these criteria nor how they will account for the wide range of particle sizes regarding sampling and classification. The materials containing the high metals concentrations will be placed into groundwater region of the existing mine voids, the materials containing medium metals concentrations will be placed above the high metals group, but out of the groundwater region. The lowest metals containing materials will be placed as cover over the other materials.

In order to obtain and prepare test samples for the PRP alternative tests, it will be necessary to use the following techniques. Mine waste piles will be selected visually at first for high, medium, and low metals concentrations using metals concentration criteria similar to that used in obtaining the samples for the EPA metallurgical tests. Further characterization using this same criteria will be done by taking large samples of each type material and then coning and separating a portion of the samples (approximately 200 pounds each) and crushing them to minus 1/2 inch using a portable jaw crusher. The samples will then be pulverized and field analyzed using a portable XRF to determine the desired metals concentration criteria. The difficulty with this procedure is that many piles may have to be sampled, crushed, and analyzed to find mine waste rock materials suitably fitting these criteria but it is the only proper way to sample and analyze materials with this wide size range.

Samples for the EPA-developed backfill alternative will be visually selected based on the criteria of using principally silicate and carbonate mine waste rock types. Representative

samples for testing mine waste rock will be collected and then physically screened at 2 inches. The plus 2-inch material will be used in leach testing. The finer material will be weighed, crushed, and pulverized, and its metals concentrations determined by XRF. Some material will be retained for possible future use.

Chat containing higher concentrations of lead and lower concentrations of zinc will be selected and then mixed with the coarse mine waste rock to fill the voids of the coarse mine waste rock in the leach test vessels.

To provide total wet chemistry metals analyses for the test samples from both alternatives, representative portions will be separated from each sample and prepared for analytical work. Due to the large size of the waste rock used in the pilot testing (a top size of approximately 8 to 10 inches), large analytical samples will have to be collected that properly represents the whole size distribution of each sample. Approximately 200 pounds of representative rock will be split from the pile, crushed, and pulverized to 100 percent minus 200 mesh (75 microns). The final samples will be split to produce two duplicate samples for wet chemical and XRF analyses. Wet chemical analyses will be performed by a subcontract laboratory with about a 1-week turnaround time. Splits from 10 percent of the samples will be sent to a CLP laboratory for check analyses.

Site reconnaissance investigation to determine the location of representative acidic groundwater sources for the tests will be done during the characterization phase of work. Water characteristics will be established using pH and specific conductivity as indicators. This work will find an adequate supply of acidic groundwater for the test programs. Up to several thousand gallons may be necessary.

After the field sample characterization, collection, and analyses phase is complete, the data interpretation will begin to finalize the pilot testing parameters. Field and analytical data are necessary to properly size the test leaching tanks and finalize the testing procedures. During this period, certain ancillary equipment, already selected, will be collected and organized. This equipment includes pumps, piping, instruments, and sampling equipment.

Design drawings will then be developed and forwarded to the selected construction subcontractor to begin construction of three leach test tanks. Upon completion of tank fabrication and final inspection and approval by CH2M HILL, the testing equipment will be transported to the test site in Galena, Kansas. A test site will be selected during the field characterization phase. Site access approval must be obtained. The site selection process must consider groundwater availability, have sample storage area, be suitable for leach water, spent mine waste rock disposal, and have limited public visibility. The subcontractor will assist EPA in setting up the testing equipment, mixing and preparing the mine waste test batches, and loading the testing tanks with the

prepared batches. Specifications to obtain bids from qualified subcontractors are being prepared. Timely approval of subcontractors by EPA are necessary to maintain the test schedule.

PHASE II. PILOT PLANT WORK

The second phase of work will be the operation of the leach tests and the collection of pertinent data. Six leach test runs have been identified--two duplicate tests of the PRP alternative; three leach tests using the additional backfill alternative (two of which will be duplicates on one rock type); and one test using the addition of fly ash to reduce groundwater permeability. The test considering fly ash additions will be conducted only after positive results of preliminary bench tests have been demonstrated. If the potential of the fly ash addition is low, pilot scale work will not be conducted for fly ash. The tests will be run in two sets of three. It is projected that each testing period will last approximately 10 to 12 days. The metals concentrations in the leach solution passing through the mine wastes should increase daily and likely reach a near equilibrium condition in approximately 5 or 6 days. A 10- to 12-day testing period should demonstrate this trend and permit extrapolation relative to expected groundwater impacts. Samples of inflow and outflow will be collected several times a day over the test runs and submitted for analysis. Criteria used in determining the sampling period will be the reaction rates within the reaction tanks. These analyses, along with data collected during the tests, will be used to modify the test procedure, if results indicate. One out of every ten samples will be collected in duplicate and sent to the CLP for chemical analyses. A schedule of analyses to be performed is presented in Table 1. During the tests, the spent liquids will be discharged back to the originating subsidence pit. At the completion of the tests, the spent mine waste material used in the testing program can then be returned to the mine waste piles that they came from.

A separate pilot test may be conducted with mine waste material mixed with fly ash. This fly ash will be obtained from the Empire Electric Power Plant near the Galena subsite as an additive to reduce permeability of the backfilled mine waste. Some simple laboratory tests are required before this test can be considered as a viable alternative. Prior in-house tests by CH2M HILL will help determine the amount of fly ash needed to mix with the mine waste rock to agglomerate the mass, and to what extent the pH of the leach solution, after leaching the mass, may rise.

TABLE 1. ANALYTICAL SCHEDULE

Onsite Analyses (Subcontract Lab)	CLP Analyses
Water Analyses	
Specific conductance pH, Eh, dissolved oxygen temperature	Dissolved Metals Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, Sn, V, Zn
Dissolved Metals --- Pb, Cd, Zn	Anions --- Alkalinity, sulfate chloride, fluoride
Anions --- Sulfate	
Solids Analyses	
Pb, Cd, Zn, S	Same as water analyses list plus Toxicity Characterization Leachate Procedure (TCLP)

Upon completion of the field leach testing program, the construction subcontractor will assist in dismantling and disposing of all equipment and mine waste material, and restoring the test site to its original condition.

Over the course of the test program, data will be compiled and a preliminary technical report prepared for submittal to EPA. Upon receipt of all CLP results, a final draft technical report will be published presenting all the validated findings of the field pilot testing program.

Section 4
SUMMARY OF TASKS

The task and subtasks scoped in this WPRR support the Cherokee County Pilot Test project only and are listed as follows:

Task--Alternative Evaluation (DEN67902)

- PM--Project Management
- QS--QAPP/FOP/SSP/FSP
- FK--Fieldwork Support
- DE--Data Evaluation
- DO--Design Oversight
- FT--Fieldwork - Source Testing
- T1--Technical Report No. 1

This task and subtasks have been established in accordance with EPA guidance and the EPA standard tasks. Each subtask is described in more detail below.

SUBTASK PM--PROJECT MANAGEMENT

This subtask is for overall management of the task. Project management activities include scheduling project staff, preparing overall task schedules, managing task costs, overall task team coordination, and coordination with EPA. The requested budget for this subtask is $6,831 and 72 LOE hours.

SUBTASK QS--QAPP/FOP/SSP/FSP

This task includes the activities necessary to plan the field work proposed for the field pilot testing program. The existing QAPP will be amended through a specific Field Sampling Plan (FSP) and Field Operation Plan (FOP) to address the field pilot testing program. In addition, the site safety plan will be updated to address these field activities. The budget for this subtask is already funded through the existing work assignment. Specifications to obtain subcontractors are being conducted in this subtask.

SUBTASK FK--FIELDWORK SUPPORT

This subtask provides funding for the first phase of sample characterization and sample collection and preparation. During this phase, subcontractors will be onsite assisting in the collection and preparation of the leach test samples. Test samples will be collected, sampled for analytical work, and stored at the test site. Large waste rock piles will be excavated using a backhoe to obtain the necessary testing material. A portion of the sampled test piles will be crushed and pulverized to produce samples for analytical work. Approximately 10 tons of

mine waste rock and chat will have to be collected and classified for the testing program. Identification and characterization of groundwater will be made and a specific groundwater selected for use in the testing program. The mine waste samples and groundwater samples will be sent to the subcontract laboratory for chemical analyses. The requested budget for this subtask is $31,216 and 160 LOE hours.

SUBTASK DE--DATA EVALUATION

During this subtask, data collected from the first phase of fieldwork will be analyzed to finalize the leaching parameters such as flow rate and possible fly ash addition rate. Design drawings for the test leach equipment will be produced using the collected field data. Other pertinent instruments and equipment needs will be finalized and purchased. The final and approved design drawing will be transmitted to the construction subcontractor for review. The requested budget for this subtask is $7,392 and 93 LOE hours.

SUBTASK DO--DESIGN OVERSIGHT

This subtask provides funding for the construction of the leach task vessels by the subcontractor. Three leach tanks will be constructed according to CH2M HILL design specifications. Necessary ancillary equipment will be provided by the subcontractor and, upon final inspection by CH2M HILL, transferred to the test site. The estimated budget for this subtask is $9,814 and 28 LOE hours.

SUBTASK FT--FIELDWORK - SOURCE TESTING

This subtask consists of the leach test equipment and instrument setup at the site, loading the tanks with the mine waste test batches, and the leach test operations. Both the construction and laboratory/sampling preparation subcontractors will be involved during the leach testing phase. The construction subcontractor will be responsible for the loading and unloading of the test equipment and any maintenance of the equipment. The laboratory subcontractor will be responsible for the chemical analyses of the leach solution on a daily basis. As mentioned earlier, up to six leach tests will be run--two in duplicate using the proposed PRP alternative using one waste rock type, three using the newly proposed alternative testing both carbonate and silicate rock types (two of which will be run in duplicate and one in single), and one test using fly ash. Three tests can be run consecutively, lasting 12 to 14 days. Two sets of three tests each will last approximately 30 days. At the end of the testing, the subcontractors will assist in the dismantling of the equipment, disposal of the waste rock, and general cleanup of the site. The estimated budget for this subtask is $54,678 and 324 LOE hours.

SUBTASK T1--TECHNICAL REPORT NO. 1

This subtask provides funds for preparing a preliminary technical report detailing the findings and activities of the fieldwork and will be submitted at the end of the testing program. A final draft report will be prepared after the receipt of all conforming CLP analyses. All data collected during the leach testing, concerning the two proposed alternatives, and the fly ash test will be evaluated and presented in this report. The requested budget for this subtask is $13,628 and 135 LOE hours.

Section 5
BUDGET AND SCHEDULE

BUDGET

The total budget estimate for the pilot testing program is $123,559 and 812 LOE hours. This budget is summarized in the attached Micro Work Plan Project Summary sheets.

SCHEDULE

The following table shows the proposed schedule for the tasks summarized in this WPRR. This timetable is dependant on the expeditious approval of documents submitted to EPA. During these field tests, the weather will play an important factor in the field reconnaissance phase of the project.

o	Begin procurement of subcontractors	March 24
o	Work Plan submitted to EPA	April 10
o	Submit FOP/FSP to EPA for approval	April 17
o	Select subcontractors	April 19
o	EPA Headquarters approval of Work Plan	April 24 (EPA)
o	EPA approval of FOP/FSP	May 1 (EPA)
o	Begin Phase I field activities	May 8
o	Begin Phase II field activities	May 26
o	Finish Phase II field activities and submittal of Preliminary Technical Report	June 28